Maintenance Initiatives for Legacy Systems

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Raytheon

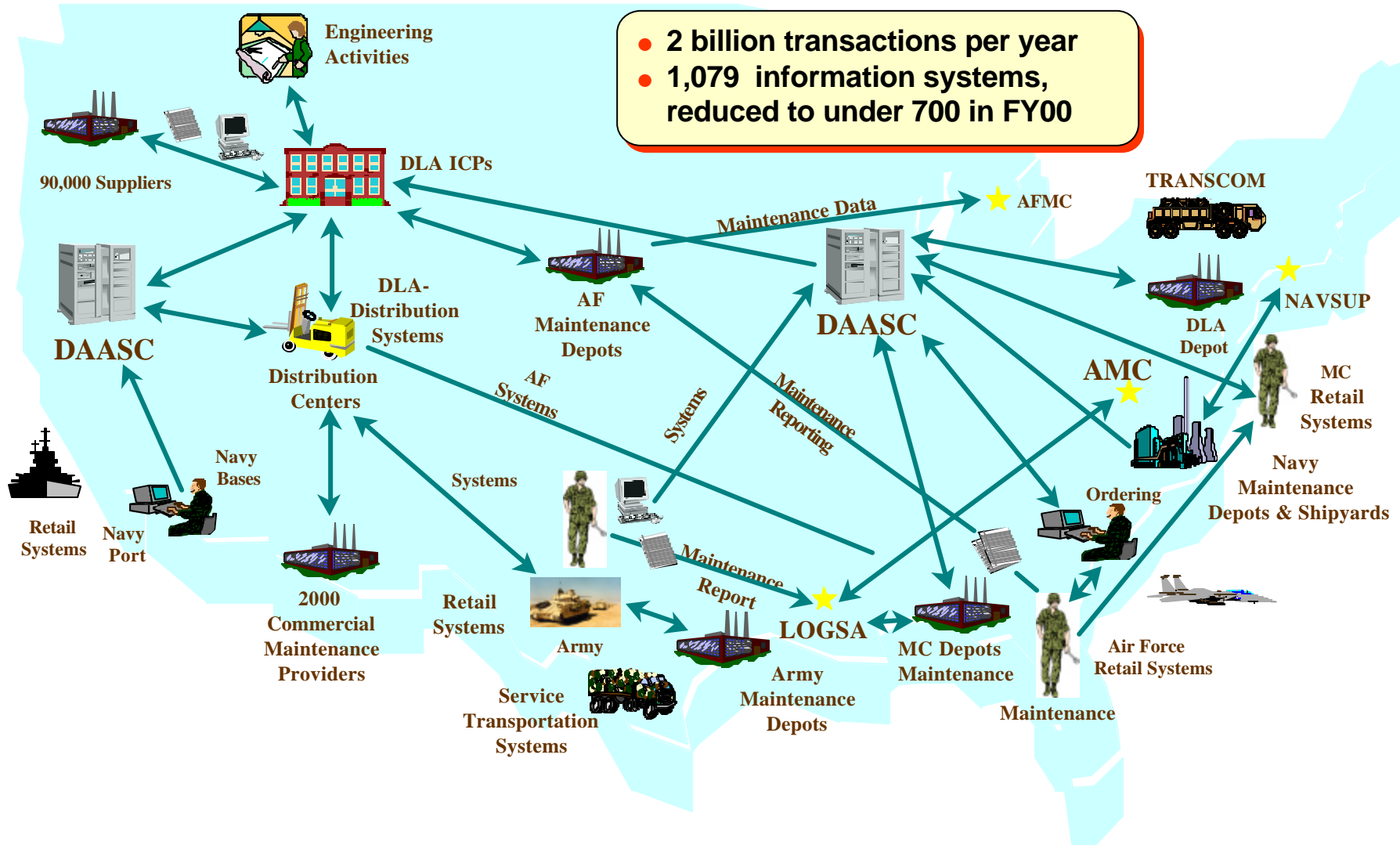# *Background Trends*

- **Fewer new weapon systems**

- **Extending useful life on legacy systems**

- **Warfighter skill sets decreasing**

- **More DoD–industry partnership and privatization**

- **Legacy support systems/processes very complex**

- **More base closures**

- **Increased "Joint" emphasis**

- **More robust DISN infrastructure**

Complex Legacy System Processes

- **2 billion transactions per year**
- **1,079 information systems, reduced to under 700 in FY00**

Engineering Activities

90,000 Suppliers

DLA ICPs

DAASC

DLA-Distribution Systems

Distribution Centers

AF Maintenance Depots

Maintenance Data

AFMC

DAASC

TRANSCOM

DLA Depot

NAVSUP

AMC

MC Retail Systems

AF Systems

Systems

Maintenance Reporting

Navy Bases

Retail Systems

Navy Port

Systems

Retail Systems

Army

Maintenance Report

LOGSA

Ordering

Navy Maintenance Depots & Shipyards

2000 Commercial Maintenance Providers

Service Transportation Systems

Army Maintenance Depots

MC Depots Maintenance

Air Force Retail Systems

Maintenance

3-4000713 (11/07/2001)

Raytheon Approach

- **Use systems engineering disciplines**

- **Leverage new technology**

- **Include business process re-engineering**

- **Leverage DoD initiatives**
  - **DISN**
  - **Interoperability**
  - **GCSS/GCCS**
  - **AME/IDE**

Sustainment Goals

1) Improve availability of weapon systems

2) Reduce total sustainment costs

3) Reduce repair turn-around time

4) Share data with multiple sites in "real-time"

5) Support more rapid deployment

Areas of Sustainment

- **Logistics**
  - Maintenance/Repair
  - Prognostics
  - Supply
  - Distribution
- **Training/Technical Manuals**
  - People
  - Courseware
  - Classes
- **Engineering support**
  - Trend analysis
  - Upgrades
  - Metrics
- **Infrastructure**

Maintenance/Repair

1) Fault detection/fault isolation

2) Collecting actual usage/trends

3) Maintenance planning

4) Actual repair work

5) Help desk

6) Distribution of maintenance data

Maintenance/Repair Initiatives

■ **Enhanced BIT**

— **Interrogating replaceable units (RU) to extract BIT/CAL values and test results**

— **Extracted data is loaded into off-weapon computers**

— **Additional analysis is performed to improve fault identification and capture "out of tolerance" conditions**
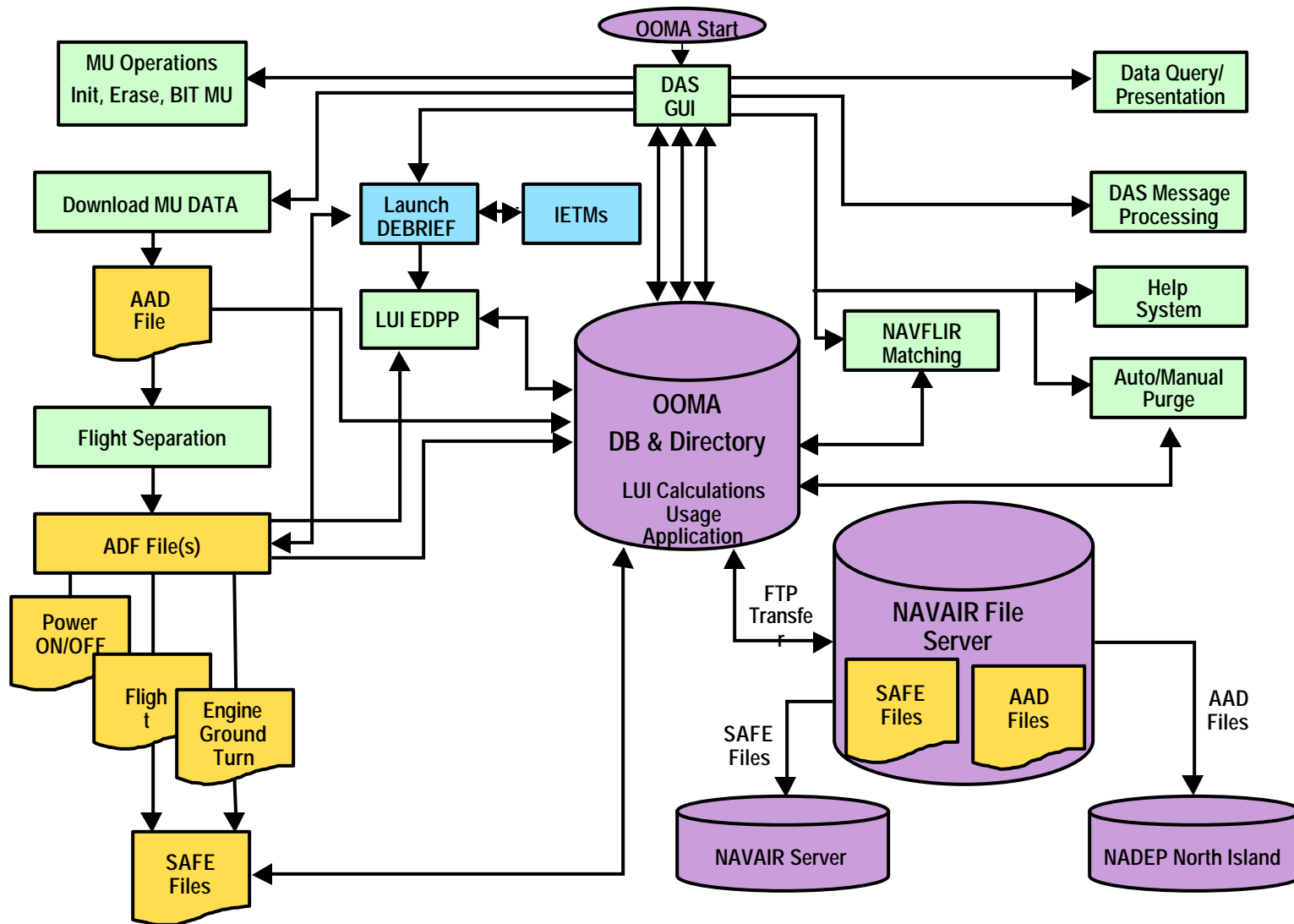
— **No hardware changes but improved fault coverage**

■ **Automated Maintenance Environment (AME)**

— **Using portable computers to extract fault and usage data from mission computers**

— **Data is stored into a common database for use by maintainers, supply, commanders, OEMs and engineers**

— **All maintainer data is collected via automatic input or directly entered data**

— **AME tools provide**

  • **More accurate and timely maintenance history**

  • **Single point-of-entry**

  • **Integrated and shared data**

  • **Instant trends**

  • **Less man-in-the-loop**

AME Objective

■ **Provide a single, scalable, comprehensive, modular product support system that offers:**

— **Diagnostics/prognostics**

— **IETM and CBT integration**

— **Tele-maintenance**

— **Total Asset Visibility/Configuration Management**

— **Comprehensive virtual enterprise**
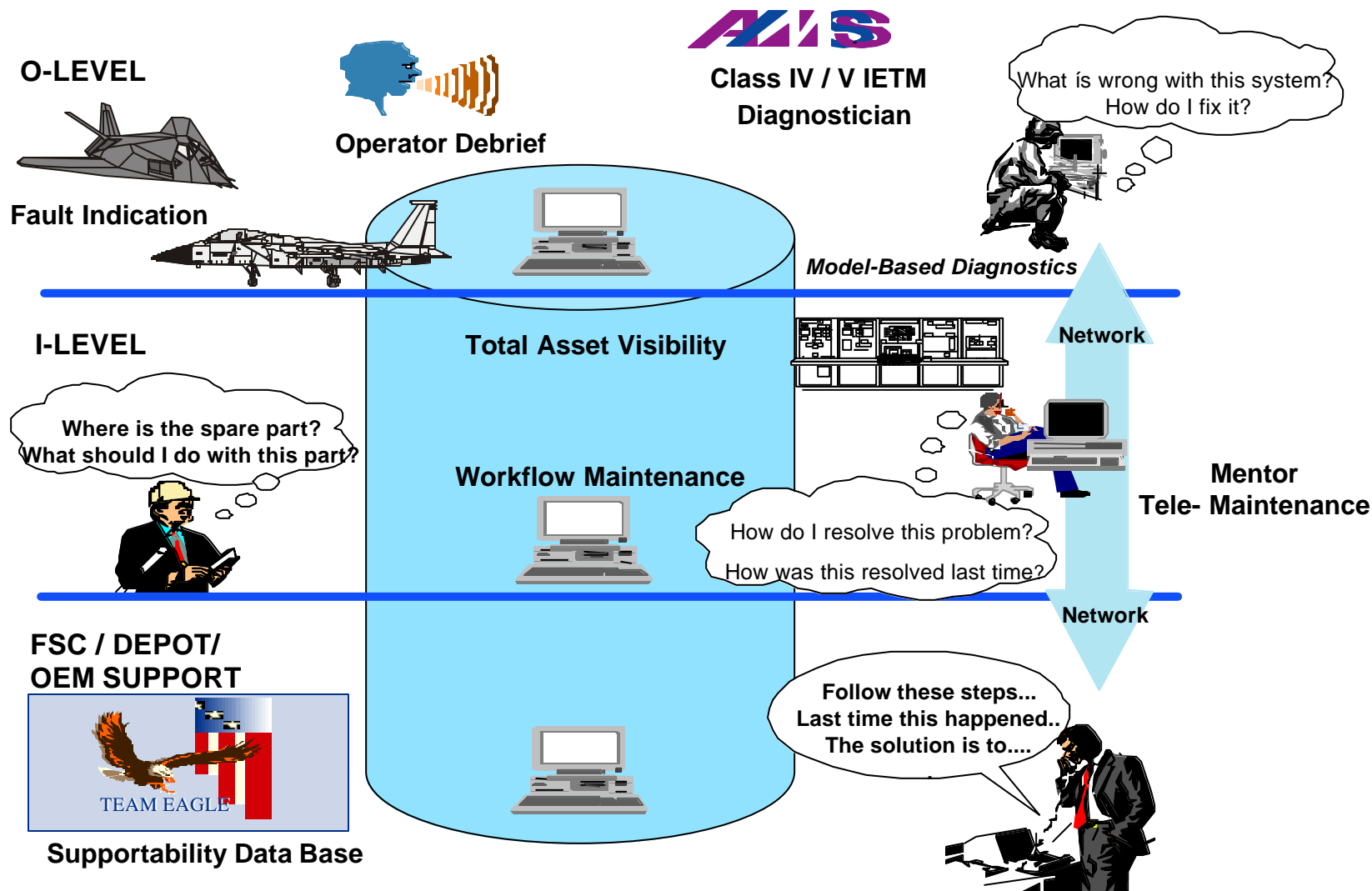
— **Common logistics/force maintenance process**

AME System Flow for F/A-18

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OOMA Start

MU Operations Init, Erase, BIT MU

DAS GUI

Data Query/ Presentation

Download MU DATA

Launch DEBRIEF

IETMs

DAS Message Processing

AAD File

LUI EDPP

Help System

NAVFLIR Matching

Auto/Manual Purge

Flight Separation

OOMA DB & Directory

LUI Calculations Usage Application

ADF File(s)

FTP Transfer

NAVAIR File Server

Power ON/OFF

Flight

Engine Ground Turn

SAFE Files

AAD Files

SAFE Files

SAFE Files

NAVAIR Server

AAD Files

NADEP North Island

The gAME Solution

Prognostics Initiatives

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1) **Analyzing performance degradation within tolerance levels over time**

2) **Identifying cause-effect relationships of faults**

3) **Using additional external hardware for additional testing**

Supply Initiatives

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- **CLS depot:**
  - — **Perform OEM depot repair**
  - — **Have control of form, fit and function requirements**
  - — **Maintain metrics**
  - — **Improved capability/less cost/less time**
- **DMS:**
  - — **Have linked our component ordering systems to our engineering drawings**
  - — **Aggressively identify parts that will be discontinued in next few years**
 - — **Allows for proactive resolution to potential DMS problem**

Training Initiatives

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- ■ **Adaptive Training**
  - — **Have linked "people's skills" info with "skills required" data from IETM**
  - — **When person assigned task, skill deficiencies for individual identified**
  - — **Individual can schedule deficient training or different person can be assigned task**
  - — **Skills database updated automatically for actual work performed**

- ■ **Interactive courseware**
  - — **Based upon IETM format**
  - — **Allows seamless transition from IETM to lesson and back**
  - — **"Train like you fight"**
  - — **Tracks skills automatically**
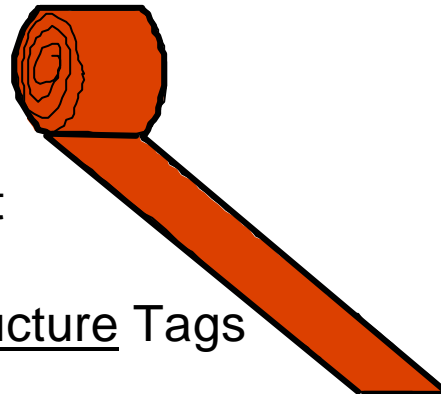 - — **Can be web-delivered**

IETM Classifications

Class 1

page 1000

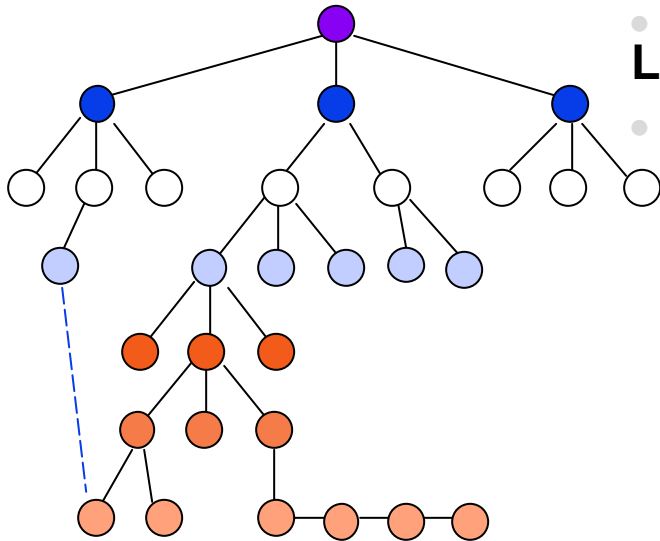page 1
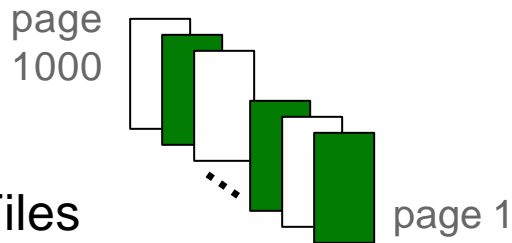
- Files
- Page Oriented
- Redundant

Class 3

- Files
- Linear
- Redundant
- Hypertext
- SGML Structure Tags
- SGML Content Tags

Class 2

- Files
- Linear
- Redundant
- Hypertext
- SGML Structure Tags

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IETM Classifications

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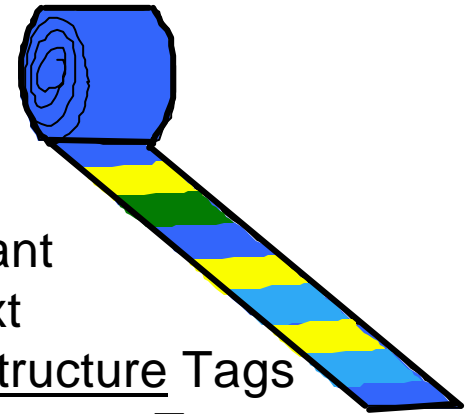
Class 4

- **Database**
- **Hierarchical**
- **Non-Redundant**
- **Relational Links**
- **Context Filters**

Class 5

Training

Overhaul

Diagnostics

Engineering Support Initiatives
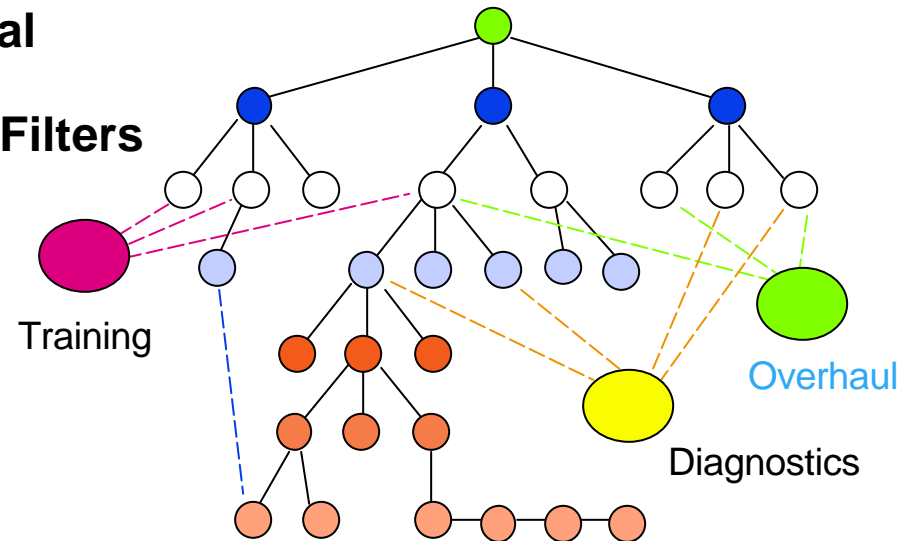
- **Integrate engineering data with logistics data**

- **Maintain LSA data after system deployed**

- **Integrate logistics data with technical manuals and courseware**

- **Analyze usage data, FRACAS data and warfighter input**

- **Identify trends and bad actors**

Existing Logistics Processes and Tools are Related, Not Integrated

TYPICAL PROGRAM

Engineering Configuration

Training Course Development

Level of Repair Analysis

Provisioning Analysis

Training Materials Development

Conferences

Logistics Task & Resource Analysis

Technical Manual Development

GVT Data System Updated

Validation and Verification Reviews

Reviews

LSA Reviews

SERDS

Spares & Repair Parts

Tools & TE

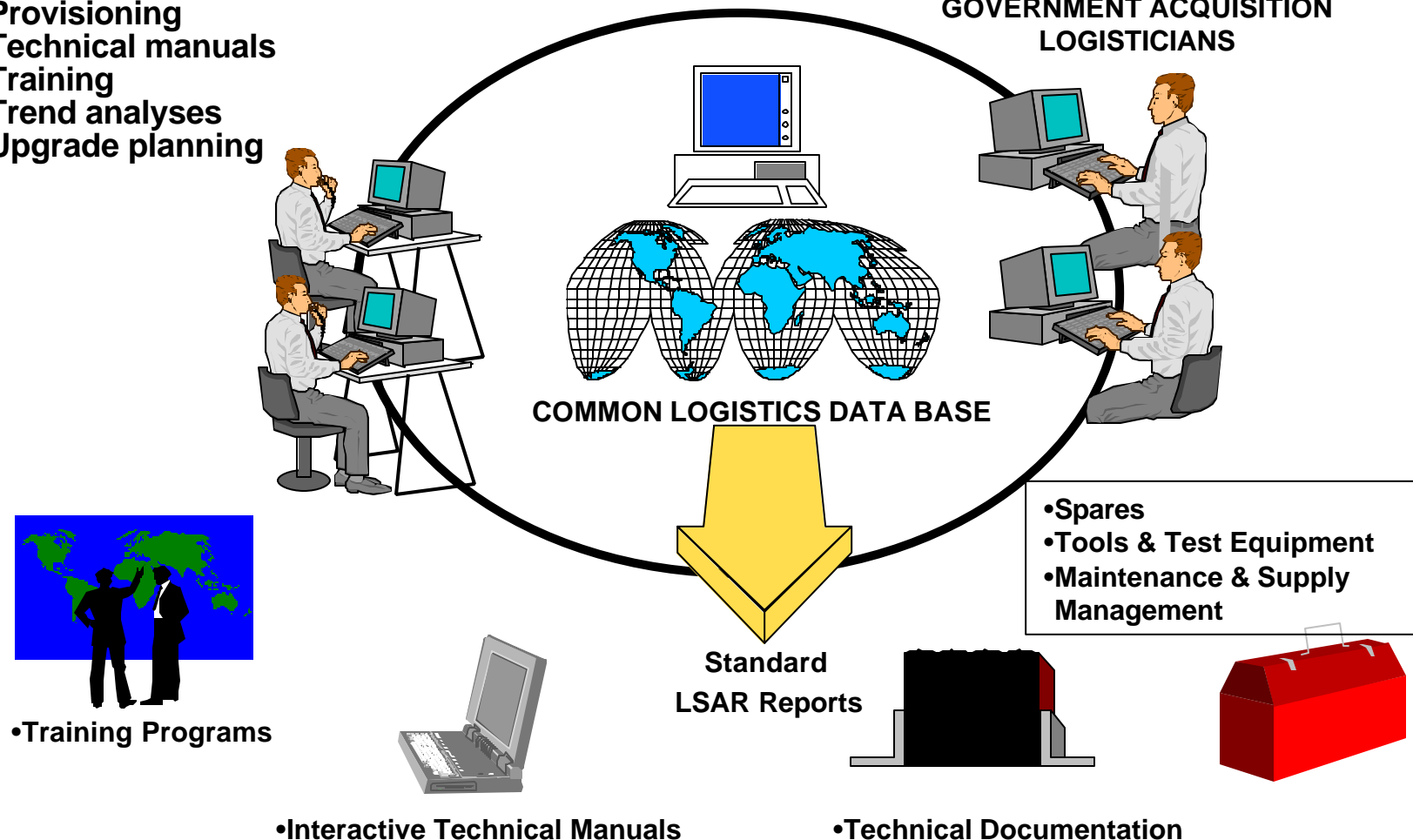Technical Documentation

Training Course Conduct

Integrated Logistics Planning Tools

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- **Contractor logistics engineers**
  - LSA
  - Provisioning
  - Technical manuals
  - Training
  - Trend analyses
  - Upgrade planning

GOVERNMENT ACQUISITION LOGISTICIANS

COMMON LOGISTICS DATA BASE

- Spares
- Tools & Test Equipment
- Maintenance & Supply Management

Standard LSAR Reports

- Training Programs

- Interactive Technical Manuals

- Technical Documentation

Infrastructure Initiatives

- **SYSTEM 2000**

- **World Wide Access (WWAX)**

- **Personal Autonomic Logistic System (PALS)**

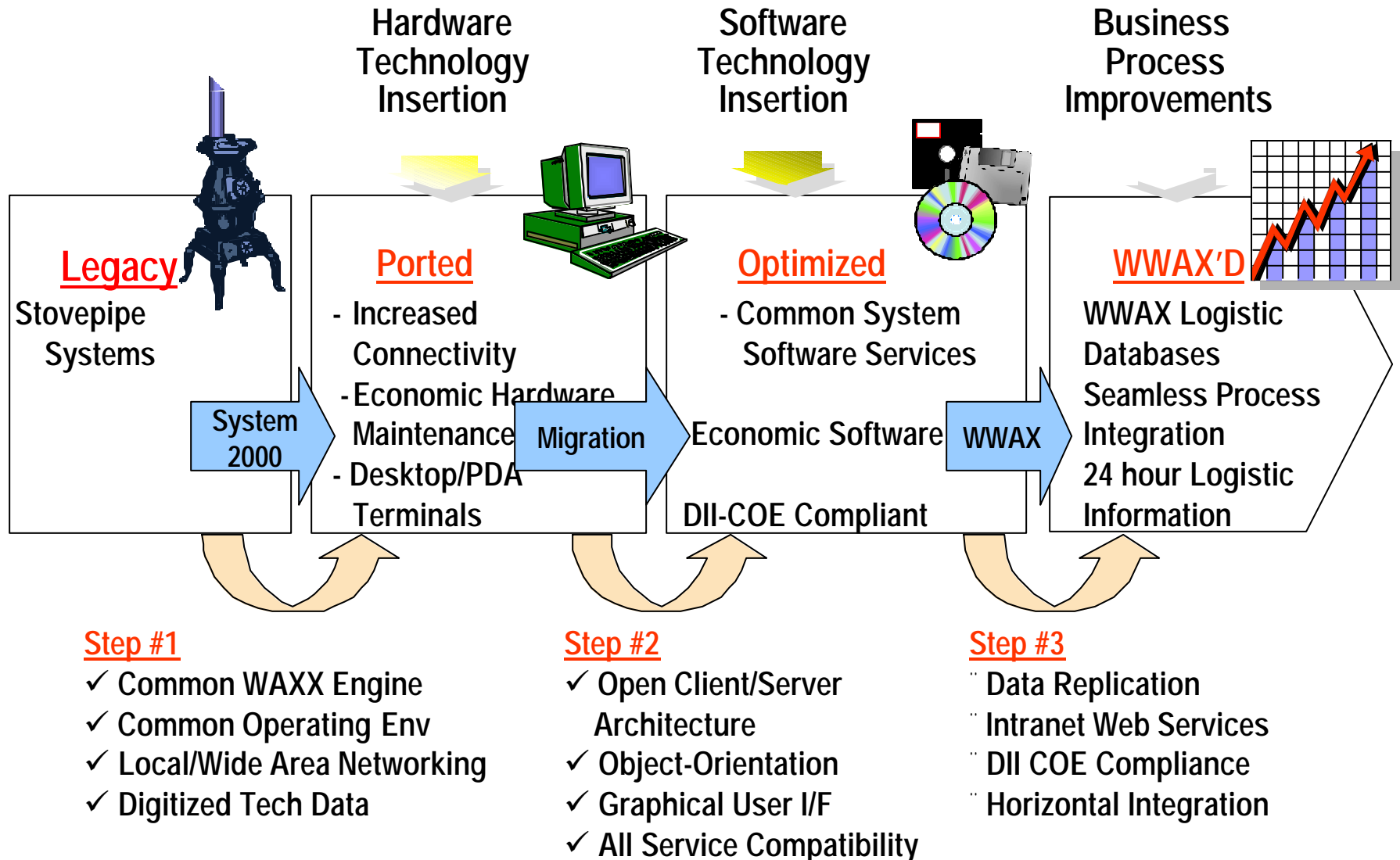- **Developer: RTS El Segundo**

- **Hardware & Software (COTS)**
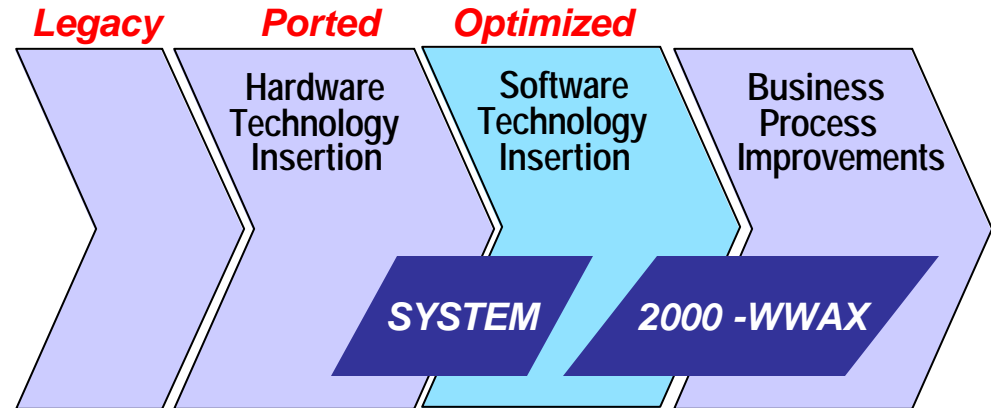
- **Basic Description of System 2000:**

  — **Provide a standardized Information Technology which shall provide the (WWAX) for all Logistic based systems**

  — **Incorporate:**

    • **Surface, Ground, Air, Subsurface based Maintenance Systems**

    • **Supply, Inventory, Food Service, Retail Sales, Finance**

    • **Administration, Manpower, Personnel, Medical based Systems**

  — **Building WWAX to the open system GCSS architecture**

  — **Use Raytheon Business Process Improvements (BPI) and Cost/Risk modeling as primary tools to build WWAX**

Legacy   *Ported*   *Optimized*

Hardware Technology Insertion | Software Technology Insertion | Business Process Improvements

SYSTEM   *2000 -WWAX*

System 2000 WWAX Migration Strategy

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Hardware Technology Insertion

Software Technology Insertion

Business Process Improvements

Legacy
Stovepipe Systems

System 2000 →

Ported
- Increased Connectivity
- Economic Hardware Maintenance
- Desktop/PDA Terminals

Migration →

Optimized
- Common System Software Services

Economic Software

DII-COE Compliant

WWAX →

WWAX'D
WWAX Logistic Databases
Seamless Process Integration
24 hour Logistic Information

Step #1
✓ Common WAXX Engine
✓ Common Operating Env
✓ Local/Wide Area Networking
✓ Digitized Tech Data

Step #2
✓ Open Client/Server Architecture
✓ Object-Orientation
✓ Graphical User I/F
✓ All Service Compatibility

Step #3
¨ Data Replication
¨ Intranet Web Services
¨ DII COE Compliance
¨ Horizontal Integration

Security Scope

- **Security Addresses:**
  - Confidentiality: prevention of compromise of sensitive/classified data
  - Integrity: prevention of unauthorized modification of data
  - Availability: prevention of "denial of service" attacks, ensuring availability of critical system services
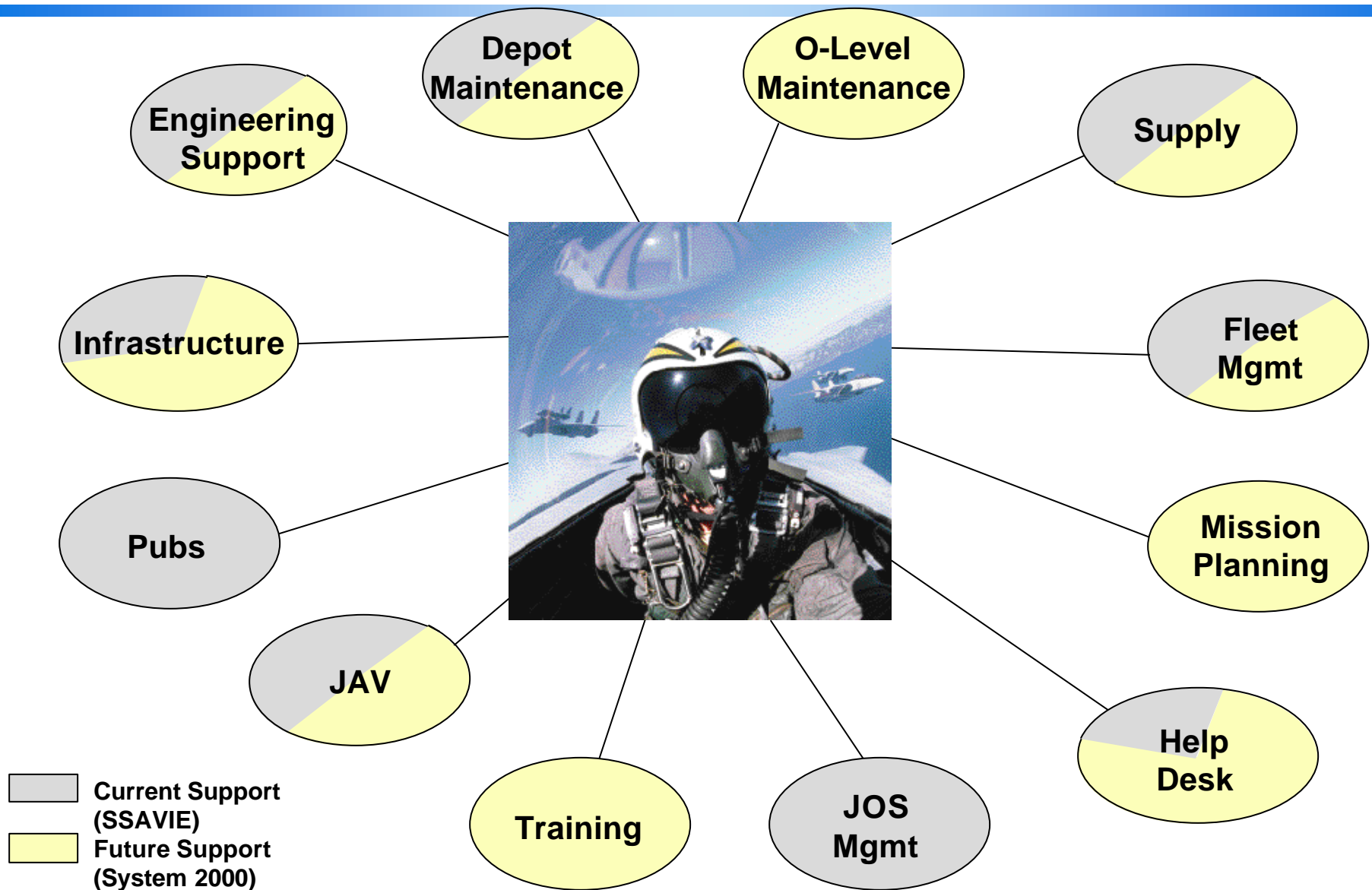
- **In a distributed system, we are concerned with security at the following levels:**
  - Users
  - Network security
  - Computer Security
  - Transmission Security & Encryption
  - Application of security technologies in conjunction with OPSEC & Physical security

Security Components

- **Identification/Authentication: users, nodes & applications**

- **Non-repudiation**

- **Encryption (accomplishes more than confidentiality)**

- **Intrusion Detection**

- **Node security (multilevel security, compartmented mode workstations, enclave architectures, application security)**

- **Wide range of techniques to ensure security functionality within and among network components:**

  — **Filters, Firewalls, Guards**

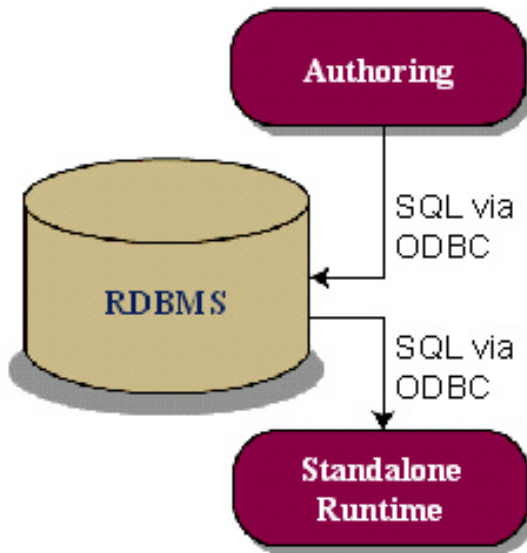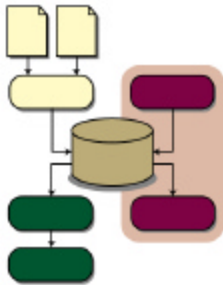 — **Security Management tools**

  — **Etc.**

SOFSA Support Capability Overview

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- Depot Maintenance
- O-Level Maintenance
- Engineering Support
- Supply
- Infrastructure
- Fleet Mgmt
- Pubs
- Mission Planning
- JAV
- Help Desk
- Training
- JOS Mgmt

Legend:
- Current Support (SSAVIE)
- Future Support (System 2000)

# *Authoring and Standalone Runtime*

- ■ **Authoring**
  - — **32-bit MS Windows application leveraging COM and ADO**
  - — **DTD independent**
    - • MIL-PRF-87269B generic layer enforced
    - • Customizable content specific layer
  - — **WYSIWYG Text & Table Editors**
  - — **Full-Featured Graphics Editor**
  - — **Versioning & Expanded Filtering**
  - — **Integrates with ICW**
- ■ **Standalone Runtime**
  - — **Class 4/5 IETM product with extensions to other applications/components**
  - — **Royalty-Free Distribution**

Legacy Data Conversion & RDBMS

SGML

Rule Set

Legacy SGML Conversion
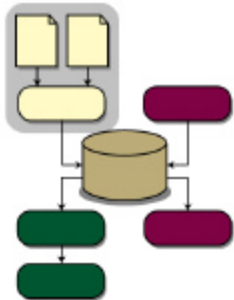
RDBMS

■ **Legacy Data Conversion**

— **Rule set driven**

— **Initial focus on Class 4 & 5 IETMs**

— **Extensible to Class 2 & 3 IETMs**

— **Allows for seamless integration of many different forms of IETM data**

■ **RDBMS**

— **Element oriented database**

— **Open access via ADO/ODBC**

— **Supports any ODBC compliant RDBMS (Oracle, Sybase, MS Access, etc.)**

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